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Published in:
Research Papers. Advancing Knowledge in Facilities Management: People make Facilities Management

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

Dialogue and collaboration for Energy Efficient Facilities Management: municipal sector strategies and the role of external service providers

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ABSTRACT

Purpose. Energy efficiency is seen as key to sustainable building operations. However, identified by literature are market failures and barriers involved in hindering energy efficiency improvements, especially in refurbishment and maintenance of existing buildings. This paper deals with the challenge of overcoming energy efficiency gaps in the municipal sector that should set an example for adjacent society.

Method: The research is based on literature that point to the need of a better match between FM organisations and energy efficiency service providers, and inform on knowledge management and public-private partnership in FM. The paper covers the empirical case of a Swedish policy that stimulates energy efficiency strategies on municipal level. A dialogue-oriented interview methodology is used to assess the current strategies and practices for buildings owned and managed by municipal FM organisations.

Findings: Silo mentality can hinder strategies and practices from becoming as comprehensive as intended by policy regulation, e.g. focus on non-residential rather than residential buildings is demonstrated by reported activities and impact on specific energy use. Findings also confirm reorientations on the Swedish energy efficiency service market, e.g. municipal organisations show greater preference for in-house capacity as opposed to long-term contractual arrangements with external companies. Collaborations are sought with energy efficiency service providers that can deliver real and perceived values, which requires a probing dialogue to result in custom-made solutions. A process-based assessment approach is suggested to characterize the maturity of municipal FM organisations and facilitate collaborations in Energy Efficient FM.

KEYWORDS Energy Efficiency Services, Facilities Management, Public Sector.

1 INTRODUCTION

The sector of residential and services, to which the majority of the building space belongs, accounted for 40% of the EU-28 final energy consumption in 2012 (Eurostat, 2014). Thus, across EU Member States the sector needs to make major contributions towards upcoming and long-term objectives on the EU climate and energy policy agenda (EC, 2014; EC, 2011). The recast of the Energy Performance of Buildings Directive (EPBD) makes the requirement that all new buildings erected from 2021 are to be nearly zero-energy buildings, and for new buildings occupied and owned by public authorities this applies already after 2018 (EPBD, 2010). However, the greater challenge – partially addressed by the Energy Efficiency Directive (EED, 2012) and the earlier Energy Service Directive (ESD, 2006) – is how to achieve major improvements in energy performance in the existing building stock, which can be operational for decades or centuries ahead.

Unless this issue is well addressed through Energy Efficient Facilities Management (EEFM), creating a surge of refurbishments and daily operations that lead to considerable improvement in energy performance, the sector will fail to make necessary contributions towards long-term energy efficient and low carbon development with adverse effects on economy, environment and social welfare.

For successful transition, in which the market for energy efficiency services is a main impetus, several stakeholders and perspectives need to be involved. Firstly, stakeholders on the energy demand side – in this case building owners, FM organisations, users and residents – will have to be adequately informed and motivated to undertake investments in energy efficient building renovations and operations. In particular, the public sector is expected to set an example (EED, 2012). Secondly, to govern private and public sector decision making, government policies need to internalize externalities related to energy use and effectively remove other obstacles to close the energy efficiency gap (Hirst & Brown, 1990). Thirdly, suppliers of energy efficient products and services need to be responsive to customer demands and create competitive offers and business models that overcome persistent market barriers (Irrek et al., 2013).

This paper involves the three main stakeholder categories. It provides an assessment of a Swedish state policy for stimulating municipal-level energy efficiency strategies (EES). It asks the question how the demand and supply side of the energy efficiency service market can be better matched. Key processes are identified for the assessment of municipal FM organisations' in-house capabilities in EEFM. As an output it suggests an approach to engage municipal FM organisations, on behalf of building owners and users, in dialogue and collaboration with external energy efficiency service providers.[1] Following this approach may lead to better service design based on in-depth understanding of customers' situation and preferences, strengths, weaknesses and improvement potentials in EEFM.

2 BACKGROUND

2.1 Project background

The study was funded by a research and market development project that aimed to bridge knowledge gaps between academia and small & medium size firms in southern Sweden and the Copenhagen region of Denmark (CCJobs, 2015). It involved collaboration over eight months between the academic partners and *EVU Energi & VVS Utveckling* (EVU), a Swedish based consultancy firm and energy efficiency service provider with some 40 employees and a business background in engineering of heating, ventilation and air-conditioning (HVAC) systems. Thus, the project took as a starting point some challenges on the energy efficiency service market as perceived by EVU. Firstly, delivered and perceived values of energy efficiency services should become more visible among building owners and FM organisations to increase their willingness-to-pay. Links between energy performance, low operating costs and benefits such as property value ought to receive greater attention. Secondly, energy efficiency services are often regarded as isolated projects, with beginning and end, rather than initiators of a continuous improvement process along a value chain. Thus, monitoring of results and decisions about succeeding steps can be neglected after first service delivery. Finally, customers' collection of energy and operational

[1] EED defines an energy service provider as "a natural or legal person who delivers energy services or other energy efficiency improvement measures in a final customer's facility or premises." In the EED and other contexts the term energy services is used, which may confuse readers that associate energy services with utilities from energy supply (e.g. heat, light, air-handling etc.). Hence, we prefer the term energy efficiency services that we equate with market services that aim to achieve energy efficiency improvements, an output of activity at a reduced level of energy input.

data is often insufficient for purposeful data management, e.g. to guide target formulations or investment decisions.

2.2 Theoretical background

The European standard for guidance on quality in FM highlights among other things the need to clarify and understand quality issues (CEN, 2011). According to Price et al. (2011) it is a matter of knowledge management to ensure that sustainable and, thus, energy efficient FM strategies are developed and implemented at a professional level to achieve energy performance targets and desired quality objectives. Drawing from traditions of quality management, the capability maturity model suggests that an organisation should improve performance by systematically increasing the maturity of its key process areas (Crosby, 1979). Over time, the approach has found various applications. For instance, Ebinger & Madritsch (2012) and Larssen (2011) have focused on maturity assessment in FM and real estate management. There have also been attempts to apply a maturity approach to energy management for compliance with international standard ISO 50001 (e.g. Antunes et al., 2014). However, to our knowledge no one has developed a domain-specific maturity model of capabilities for energy efficiency improvement in buildings by municipal-level FM organisations. A generic guideline for the development of maturity grids has supported our effort in this regard (Maier et al., 2012).

A challenge is how many and what sources of information that are needed to create a municipal EEFM maturity model. The assessment of the Swedish policy support for municipal EES was considered a good starting point for scanning evidence of ongoing efforts in this domain, and interviews could be conducted with municipal-level strategists and managers of FM organisations. In addition to this empirical basis, the paper draws on energy efficiency policy and market studies. A basic assumption is that EEFM in the municipal sector, and elsewhere, requires inputs and collaborations with external providers of energy efficient services and equipment to optimise building operations. In 2004–2008, contractual arrangements like Energy Performance Contracting (EPC) showed rapid growth in Swedish public sector (Bertoldi et al., 2014). Besides underlying drivers – rising energy prices, favourable policies, and climate change concerns (Lindgren Soroye & Nilsson, 2010) – EPC was facilitated by marketing and by being tailored to the value chain of energy efficiency services. In recent years, however, EPC has had setbacks (Bertoldi et al., 2014). There is no clear successor on the Swedish energy efficiency service market but there are many expectations for what buildings could provide to its owners, users and society at large.[2] For existing buildings to become energy efficient and provide additional benefits such measures have to be valued accordingly (IEA, 2014). Given the range of possibilities and risks involved it is a matter of knowledge management for FM organisations to reach sound decisions about e.g. when to hire expertise, and how to collaborate to be adequately informed about viable and cost-effective solutions.

3 METHODOLOGY

A participatory research approach is important in the area of sustainable and energy efficient FM, and deemed necessary when researchers are to suggest solutions for improvement in strategy and practice. Thus, one of the authors collaborated closely with EVU, which involved spending

[2] For instance: generate net surplus of renewable electricity, recycle water, be part of a smart grid that communicates with power supplies and loads, co-exist with natural environments or even preserve wildlife (DOE, 2015).

between one and two days a week with the firm, to support the desired change process towards learning to better initiate, demonstrate and sustain its partaking in EEFM. [3]
The assessment of EES was limited to municipalities in the southernmost province of Sweden, which is the main market for EVU. Multiple methods were applied for qualitative data collection. Initially, screening and analysis were done of formal EES in eight municipalities. Then, face-to-face interviews were conducted with representatives of the same municipalities, designated strategists and managers of municipally-owned FM organisations. Interviews were semi-structured and prepared to centre the dialogues on:

1) the objectives of the policy support for municipal EES and the municipalities' approach for compliance in target-setting, scope and selected measures,
2) a categorisation of basic models for energy efficiency improvement in municipal buildings,
3) the main phases and key processes that underpin the practical implementation of EEFM.

4 RESULTS

4.1 Municipal energy efficiency strategies

Since 2010 a Swedish government policy has supported municipal EES (SFS, 2009:1533). The grant is between 30,000 and 45,000 per year depending on municipality size. Beneficiaries should:

- establish an EES with targets to be achieved by 2014 and 2020,
- launch an action plan and actively implement the EES,
- undertake at least two out of six specific energy efficiency measures,
- report progress to the administrating agency, the Swedish Energy Agency.

The specific energy efficiency measures conform to the list of measures that public sector bodies should apply to fulfil an exemplary role according to EU and national regulations (ESD, 2006; SFS, 2009:893):

1) use financial instruments, including EPC, that stipulate the delivery of measurable and pre-determined energy savings;
2) purchase energy efficient equipment based on official lists of product specifications;
3) purchase equipment that is energy efficient in all modes, including standby mode;
4) replace or retrofit equipment with the equipment referred to in (2) and (3);
5) undertake energy audits and implement the recommendations therein,
6) purchase or rent energy efficient buildings or parts thereof, or replace or retrofit purchased or rented buildings or parts thereof to render them more energy efficient.

The EES shall cover the whole municipal organisation, all buildings owned or managed by municipal administrations or companies (STEMFS, 2010:5). From a screening of formal strategy documents in eight municipalities Table 1 compiles information about the scope of building space covered, set targets and selected measures as numbered above. Findings from interviews about the three aspects are briefly mentioned here and in the subsequent discussion:

- **Scope:** Though strategies ought to be comprehensive it was often found that activities focused on non-residential buildings occupied by the municipalities' own administrations (e.g. schools, offices etc.). Apart from annual reporting of energy use to the strategists, municipal housing companies appeared to operate autonomously from the EES.
- **Targets:** After initial uncertainty there seems to be agreement among municipalities and the administrating agency that the target definition is understood as a percentage reduction of

[3] Activities involved interacting with management and staff to discuss market features, attending meetings with customers in office and in field, representing the project at exhibition.

purchased energy relative to aggregated building space compared to the base-year 2009. It is not obvious that this interpretation is consistent with regulations. As shown in Table 1 there are quite large variations in ambition levels.

- **Selected measures:** The stipulated specific energy efficiency measures were often perceived as vague. The respondents found it particularly difficult to differentiate between (2), (3) and (4), and the general description of (6) allowed for a variation of interpretations.

Table 1 Overview of EES in the eight municipalities.

Municipality (inhabitants)	Building space covered [m2, heated floor area]	EE target (base-year 2009)	Selected EE measures
M1 (15,000)	Non-residential: 75,000 Residential: 40,000	2014: -10% 2020: -20%	(1), (2), (3) and (5)
M2 (16,000)	Non-residential: 75,000 Residential: 35,000	2014: -3% 2020: -5%	(2) and (4)
M3 (23,000)	Non-residential: 90,000 Residential: 0	2014: -18% 2020: -28%	(4) and (5)
M4 (32,000)	Non-residential: 150,000 Residential: 170,000	2014: -10% 2020: -20%	(5) and (6)
M5 (51,000)	Non-residential: 350,000 Residential: 100,000	2014: -10% 2020: -20%	(1), (3), (5) and (6)
M6 (82,000)	Non-residential: 700,000 Residential: 800,000	2014: -8% 2020: -16%	(2), (4) and (5)
M7 (116,000)	Non-residential: 700,000 Residential: 650,000	2014: -15% 2020: -30%	(2), (3), (4), (5) and (6)
M8 (135,000)	Non-residential: 650,000 Residential: 1,200,000	2014: -4% 2020: -8%	(5) and (6)

Based on the municipalities' self-reported data Figure 1 and 2 demonstrate trend developments in specific energy use for the average building stock of non-residential and residential buildings owned or managed by the municipal FM organisations.

In 2013 compared with 2009, the reported specific energy use for the average non-residential building stock:

- decreased in seven municipalities, which puts them on track to fulfil or even over-achieve their energy efficiency targets,
- increased in one municipality, possibly partly due to a larger sports facility being closed for renovations in 2010–2012.

In 2013 compared with 2009, the reported specific energy use for the average residential building stock:

- decreased in two municipalities, which are on track to achieve their energy efficiency target for 2014,
- increased in five municipalities and quite substantially in two of these.

Figure i Purchased energy including end-user electricity use for municipal non-residential buildings. Source: SKL (2014)

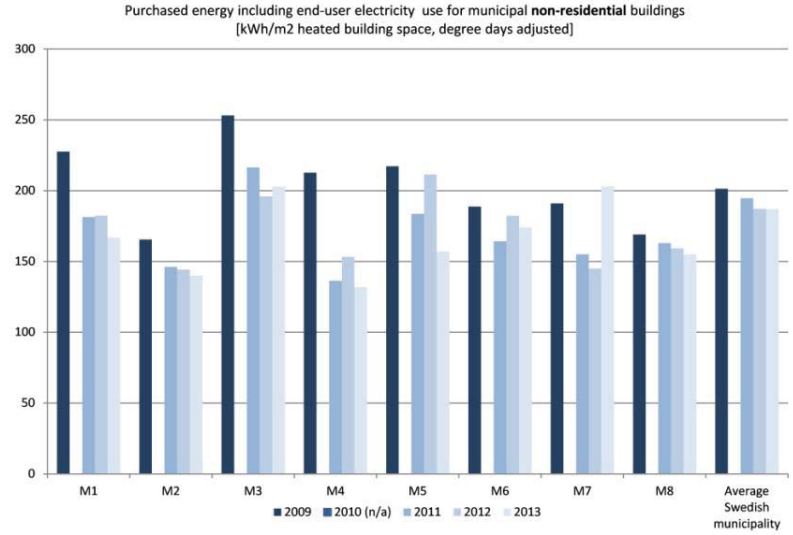
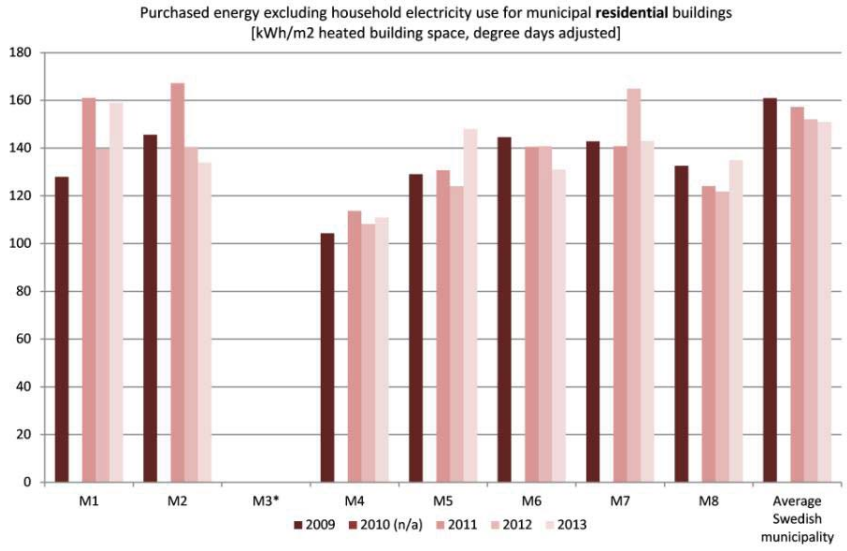


Figure 2 Purchased energy excluding household electricity use for municipal residential buildings (*M3 holds no residential buildings). Source: SKL (2014)



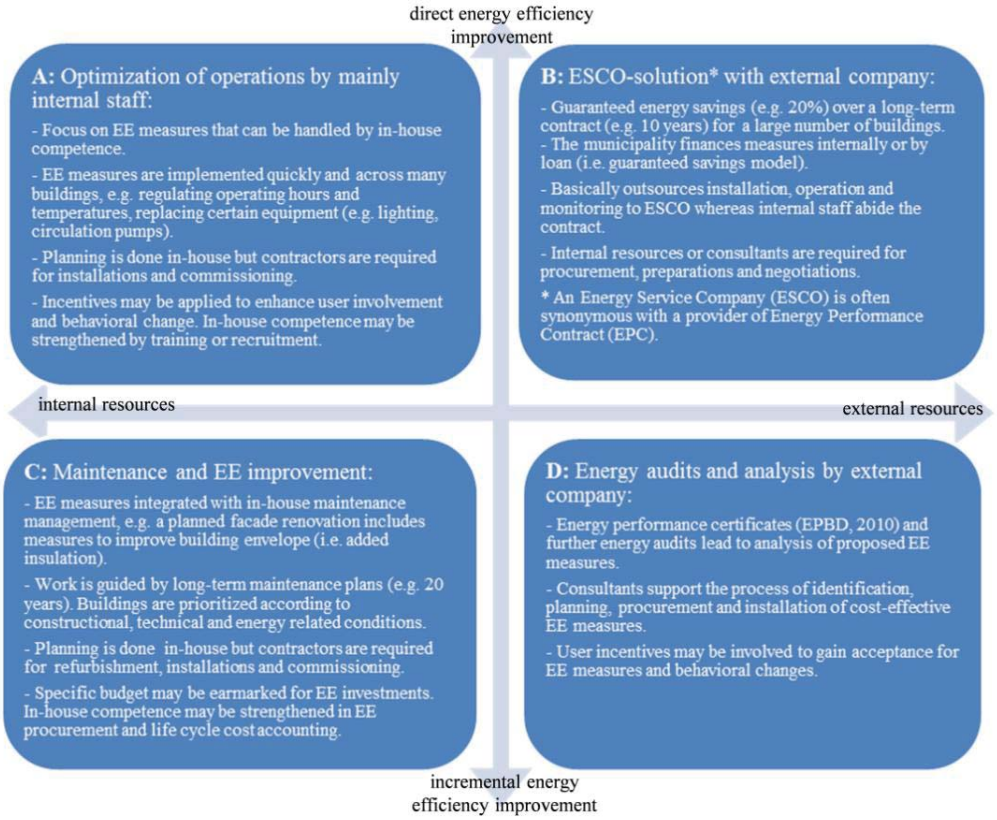
4.2 Models for energy efficiency improvement in municipal FM organisations

Intended strategy can be different from realised strategy, which is relevant in the case of municipal governments and bodies. Elected politicians ought to make principal and strategic decisions about public services while administrations and employees are responsible for preparation and operation. Municipal FM organisations are relatively large and divided into administrations and municipally-owned companies with different areas of responsibility, and with contractors and consultants hired for various tasks.

To examine the links between politically endorsed strategies and actual operations, respondents were asked about which out of four proposed models that describes the energy efficiency practices of the FM organisations. The models, shown in Figure 1, derive from a study of energy efficiency

practices in Danish municipal buildings (Jensen et al., 2013). The horizontal axis distinguishes between the involvements of internal or external resources whereas the vertical axis distinguishes between an incremental or more direct rate of energy efficiency improvement. Minor modifications were done for adaptation to Swedish context.

Figure iii Basic models for energy efficiency in municipal buildings (see Jensen et al., 2013).



In most cases, the answers about utilized models relates only to non-residential buildings, as respondents lacked knowledge or appeared reluctant to give detailed accounts about the approach taken by municipal housing companies. Table 2 shows that optimization of operations (A) and maintenance and energy efficiency improvement (C) were often stated as currently applied and preferred models. On the other hand, some interviews revealed scepticism and disappointment related to the ESCO-solution (B), e.g. fails to deliver expected energy savings and negatively influence other performance criteria, overly focused on least cost measures, troubled by technological and contractual lock-in effects.

4.3 A maturity approach to energy efficiency FM

In search of the capabilities of EEFM, the interviews probed the concept to identify phases and key processes as outlined in Figure 4. The phases form an energy efficiency value stair-case starting from basic orientation about problems and solutions extending up to demonstration of results from implemented measures. Each phase consists of the underlying key processes that through interviews and supportive literature are suggested as important constituents of EEFM.

Table 2 Current and preferred future models for energy efficiency.

Municipality (residential and/or non-residential buildings)	A	B	C	D	Comments and preferences about current and future model(s)
M1 (non-residential buildings)		X			70% of non-residential is in (B), a long-term contract with guaranteed cost performance. It has been disappointing and the FM organisation is dissatisfied with the situation. Wants to reach (C) after thorough audits and analysis (D).
M2 (residential and non-residential buildings)	X		X	X	Believes all three selected models should be considered as part of a total approach to achieve tangible energy efficiency results. Wants to continue to combine (A), (C) and (D). Show aversion against ESCO-solution (B).
M3 (non-residential buildings)	X			X	Focus on optimization measures (A) combined with energy auditing (D) to identify measures to be implemented according to an investment plan until 2020. Thus, continuation of (A) and (D) is expected for some time ahead.
M4 (non-residential buildings)	X		X		Combines (A) and (C) to mix larger investment projects with operation and maintenance, training and recruitment has enhanced in-house capacity. Wants to continue combining (A) and (C). Show aversion against ESCO-solution (B).
M5 (non-residential buildings)		X			A majority of non-residential buildings has been in (B), an EPC since 2009. There is uncertainty but ongoing investigations will support decisions about future approaches.
M6 (residential and non-residential buildings)	x		X	x	Focus on (C) as the main model, but (A) and (D) are also entered. Is confident that in-house capacity is best suited for the task. Consultants are hired for well-specified demands. Wants to continue focus on (C).
M7 (non-residential buildings)	X		X		A combination of (A) and (C) describes the approach. 25% of non-residential buildings were previously in (B) but the FM organisation left the increasingly criticized EPC ahead of plan in 2011. Wants to continue with (A) and (C).
M8 (non-residential buildings)	X		x		Foremost (A) but has outsourced the task to contractors that are incentivized to optimize operations. Users are also engaged to take house-keeping measures. The current set-up with (A) and occasionally (C) is foreseeable in near term.

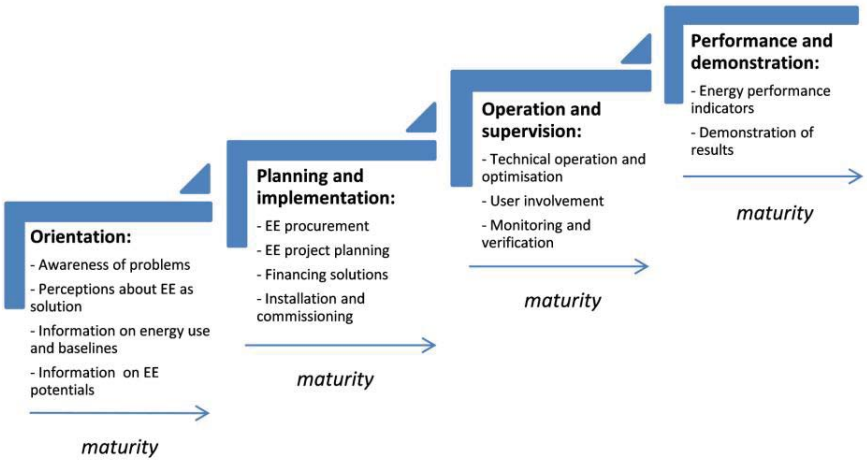
For each key process municipal FM organisations should be assessed against a descriptive yardstick and assigned a maturity level (e.g. from "ignorant" to "professional"). Awareness-raising about current situation and maturity improvement potentials should support decisions about steps to take in-house and in collaboration with energy efficiency service providers. The process designations are particularised under their phase headlines below.

4.3.1 Orientation phase

- Awareness of problems related to excessive energy use (e.g. economic, environmental and social).
- Perceptions about energy efficiency improvement as a viable and cost-effective problem-solving technique.

- Access to information/data on the buildings' energy use and energy baseline.
- Access to and handling of information about buildings' energy efficiency improvement potentials.

Figure 4 Phases and key processes of municipal Energy Efficient FM.



4.3.2 Planning and implementation phase

- Procedures for energy efficient procurement to improve energy performance of equipment and services.
- Procedures for energy efficient project planning of new buildings or renovations.
- Ability to identify and secure financing solutions for energy efficient investments.
- Preparation, installation and commissioning of measures related to energy using equipment.

4.3.3 Operation and supervision phase

- Technical operation for optimization of energy use.
- Energy end-user involvement for energy efficiency improvement from behavioral measures.
- Measurement and verification of energy efficiency measures and results.

4.3.4 Performance and demonstration phase

- Performance based indicators, e.g. purchased energy for the aggregated building stock or certain building types [kWh/m^2, heated floor area].
- Translation and communication of energy efficiency results in terms of multiple benefits that go beyond energy cost reduction (e.g. job creation, environmental improvement, poverty reduction).

5 DISCUSSION

5.1 Scope, targets and measures of municipal energy efficiency strategies

Management literature has suggested many perspectives on the strategy concept and claimed that heterogeneity is needed to pose fundamental questions about organisations (Mintzberg, 1987). Thus, a municipal EES is potentially rich in content. The assessment results lend itself to a discussion about scope, targets and selected measures as stipulated by the policy.

5.1.1 Scope

Despite policy objectives about comprehensive EES the interviews showed that most municipalities focused on non-residential buildings. Some strategists could not provide relevant information about municipally-owned housing companies, and silo mentalities appear to hinder some from establishing municipal-wide cooperation. Symptoms include:

- lack of communication between strategists, responsible for coordination and reporting, and managers in FM organisations responsible for building operations,
- low awareness and interest in common targets and politically endorsed measures,
- conflicting views about which division that should receive the grant for EES.

In cases of rewarding communication and collaboration a combination of personal skills and organisational stability appears to be the success factor.

When comparing the two subsets of buildings in the eight municipalities, self-reported data reveals a trend of improvement in specific energy use for non-residential buildings whereas for residential buildings it is the reverse. One explanation to this intriguing difference could be that strategic efforts have indeed focused on non-residential buildings. The underlying rationale could be that in non-residential buildings the tenants are the own municipal administrations. Thus, politically regulated rents could create pressure to reduce operating cost through cost-efficient energy efficiency improvement measures. In the residential sector, however, the municipal housing companies can more easily pass over high operating costs from excessive energy use to the private household tenants.

5.1.2 Targets

After initial uncertainties around baselines issues and absolute versus relative targets, interviewed municipalities regarded their targets as percentage reductions of purchased energy relative to the aggregated space of non-residential and residential buildings.[4] Targets of -10% by 2014 and -20% by 2020 are common but there are outliers on both ends of the scale. Normalisation of weather variability has sometimes been applied to adjust annual heating demand. However, municipalities do not appear to consider how structural changes in building portfolios (e.g. divestments, demolitions and constructions) influence average specific energy use and target fulfilment. A "strategy" could be to divest buildings with poor energy performance and achieve targets without taking tangible energy efficiency improvement measures in existing buildings.

Neither the Swedish Energy Agency or the Swedish Association of Local Authorities and Regions have considered baseline issues in the monitoring of municipalities' self-reported data (SKL, 2014). Thus, estimates about policy impact in terms of energy savings are uncertain. For qualified estimates on energy efficiency improvements in the municipal building stock, future research and policy evaluations could analyze disaggregated data sets by regression or decomposition methods.

5.1.3 Measures

According to formal EES documents all municipalities selected at least two energy efficiency measures from the prescribed list. To what extent have selected measures been implemented? Interviews gave diverse answers. In one municipality the respondent was unaware about this obligation and in two municipalities respondents browsed their papers for some time before answering hesitantly. Some municipalities had selected measures that were implemented before the grant was received, and others carried out other measures than those initially stated. In four of the eight municipalities, it was clear that selected measures had been translated into tangible energy

[4] Thus, as reduction of specific energy use in kWh/m^2/year by 2014 and 2020 compared with base-year 2009.

efficiency actions implemented by the FM organisations. The mixed outcome could relate to that stipulated measures were perceived as vague, allowing for interpretations about compliance. The practical implications of stipulated measures are uncertain and disparate.

5.2 Usability and usefulness of a maturity approach to Energy Efficient FM

The paper has presented initial steps in the development of a maturity model aimed at assessment, awareness-raising and improving capabilities for EEFM. The key processes have been identified but it remains to finalize the exact descriptive content at each maturity level. For a process-based maturity model to become an applicable tool it has to be well received by intended users, i.e. municipal strategists and FM organisations but also energy efficiency service providers that want to initiate, demonstrate and sustain its partaking in EEFM. In terms of usability, users should understand the terminology and concepts applied to explain processes and maturity levels. In terms of usefulness, users have to find the tool effective, fit-for-purpose in supporting assessment, awareness-raising and contributing to improved capabilities in EEFM.

Validation of usability and usefulness should involve intended user groups and preferably other stakeholders (e.g. experts from academia and practice). The interviews with municipal strategists and managers of FM organisations included some validation activities. Starting with a less detailed value chain of energy efficiency services, respondents were asked to comment on proposed key processes, terminology and relevance related to their situation. Based on this input the structure and content was gradually refined through a participatory and iterative procedure. Some strategists expressed a demand for supportive tools to raise their own and their stakeholders' awareness about EEFM and to assess the performance of FM organisations. Some considered introducing a municipal-wide energy management system in compliance with international standard. The maturity approach could guide such an important and potentially costly decision and in itself contribute to the plan-do-check-act approach.

Presentations to management and staff at EVU gave feedback on processes related to their core business. It was affirmed, not without disagreements, that the suggested approach could become a viable tool to initiate customer dialogues and to extend their remit and provision of energy efficiency services along the value chain. Additional review was provided in academic seminars with researchers from the FM discipline and from energy systems analysis, which attested that essential issues were acknowledged and that content was understandable. Further focus group validation is planned during a network meeting for municipal strategists, which are to self-diagnose their organisational maturity in EEFM. This is to be followed by academic publications of the complete EEFM maturity model. Meanwhile, users may introduce the approach in practice and develop it according to their preferences.

6 CONCLUSIONS

The assessment of municipal energy efficiency strategies (EES) shows that these are less comprehensive than stipulated by policy. Contributing factors can be perceptions about vague policy objectives and prescriptions but also internal obstacles to communication and collaboration across the organisational borders of municipalities. Realized strategies and measures have foremost involved non-residential buildings, in some cases with substantial impacts on reported specific energy use. Untapped energy efficiency improvement potentials are likely to reside in residential buildings managed by municipally-owned housing companies.

The study confirms changes in the Swedish energy efficiency service market. Municipal FM organisations increasingly demand collaborations with energy efficiency service providers that deliver real and perceived values. The somewhat idealistic solution is collaborative and trustful

relationships rather than long-term and sophisticated contractual arrangements. Through dialogue, service providers could learn to know their customers and refine custom-made offers.
Several of the identified key processes of EEFM are currently underdeveloped in municipal FM organisations. This could provide opportunities for new value propositions, services and alliances on the energy efficiency service market. The suggested maturity approach supports a dialogue around these issues for FM organisations and energy efficiency service providers to better match capabilities in EEFM.

ACKNOWLEDGMENTS

Funding and support from EU Interreg and the CCJobs consortium is gratefully acknowledged.

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